Section 319 *NMP Projects*:

Do BMPs Really Work?

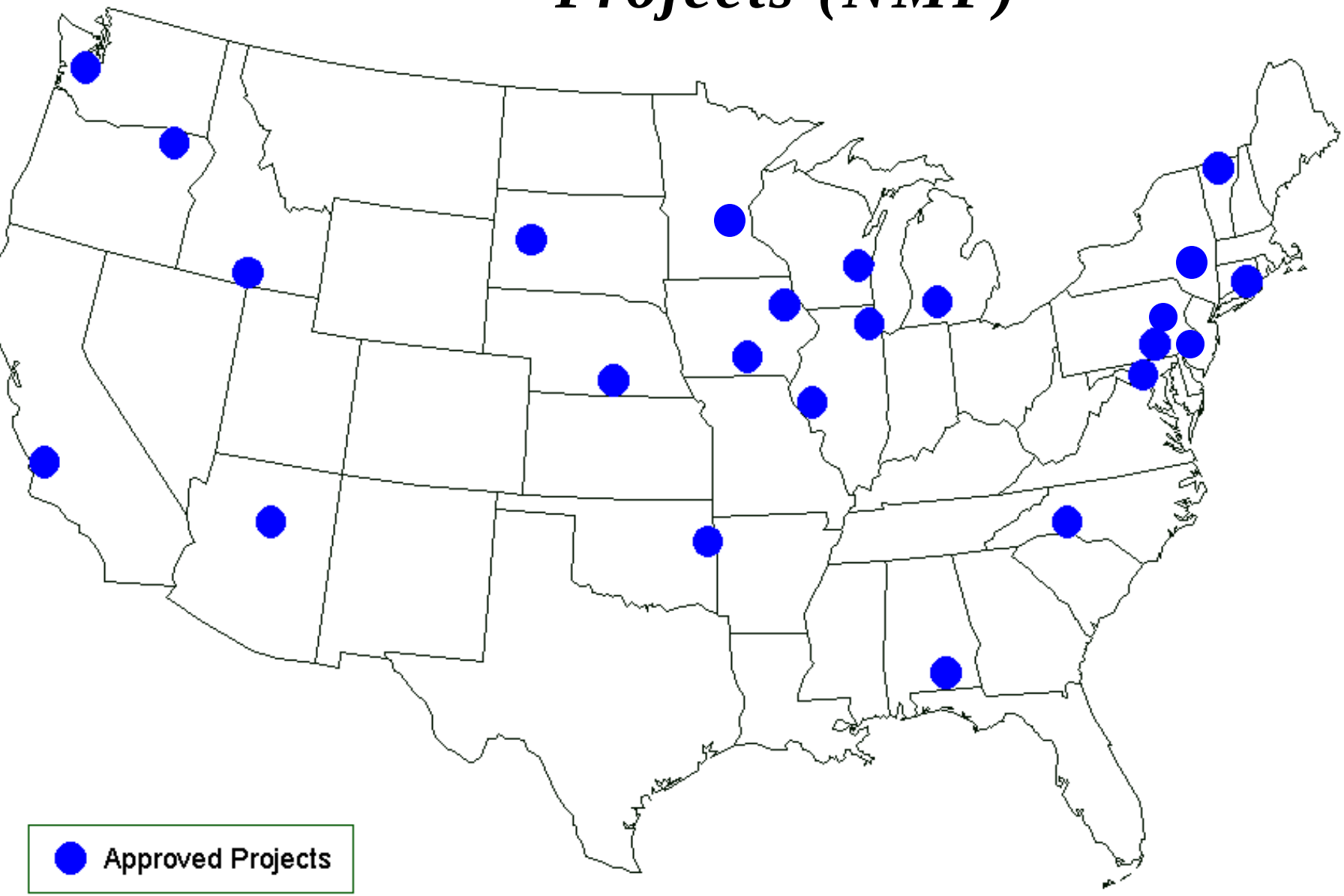
Morro Bay NMP: a ten-year study

and selected project highlights

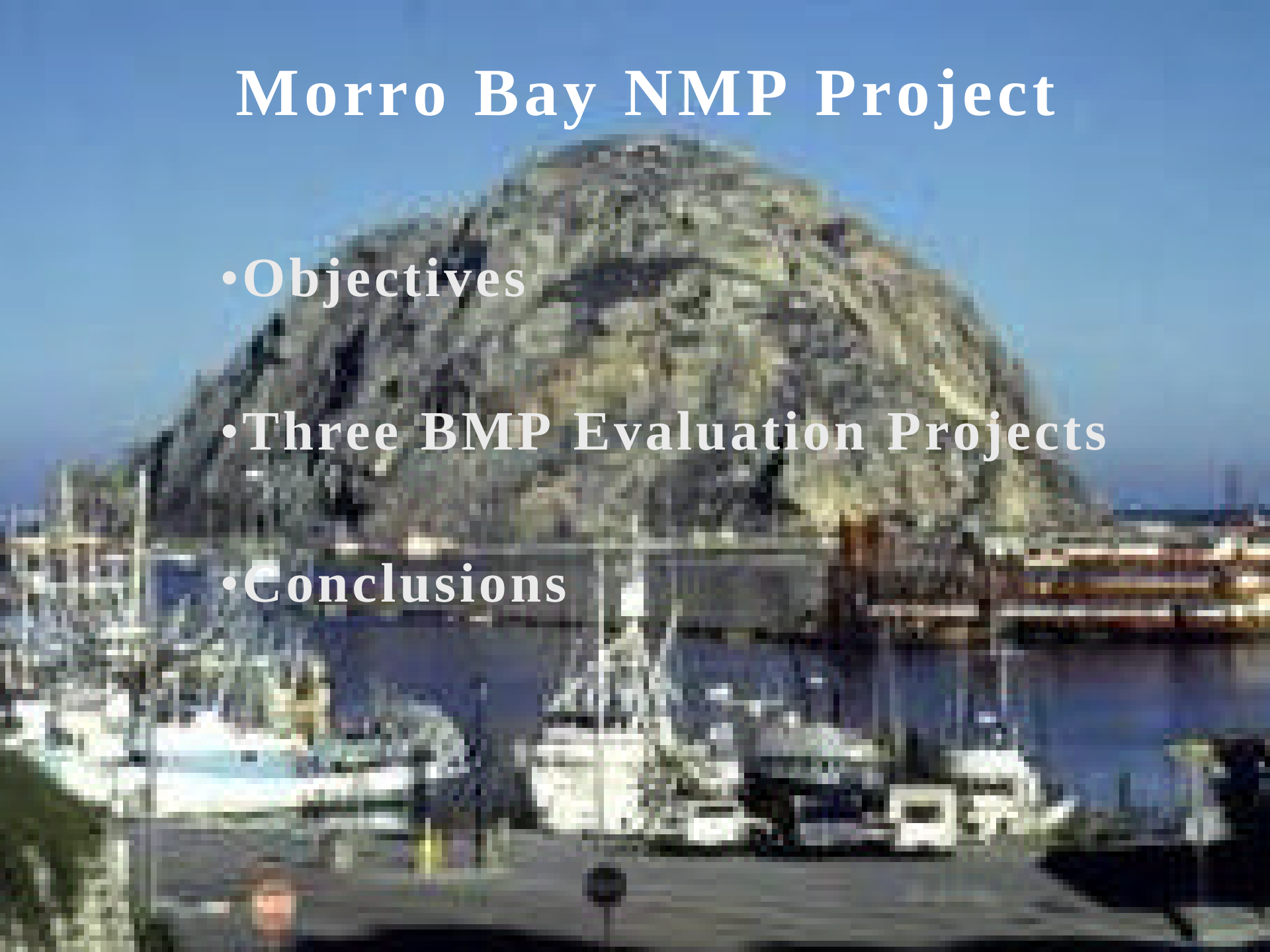
Katie McNeill, Dr. Lynn Moody, Dr. Brian Dietterick, Dr. Brent Hallock,
Dr. Jon Beckett, Karen Worcester, David Paradies, and John H. Davis IV
with contributions from additional staff, student interns, and volunteers

project conducted by the
Central Coast Regional Water Quality Control Board and
California Polytechnic State University San Luis Obispo
in cooperation with the
U.S. Environmental Protection Agency and North Carolina State University

USEPA Section 319 National Monitoring Projects (NMP)



Morro Bay NMP Project



- Objectives
- Three BMP Evaluation Projects
- Conclusions

Other NMP Project Highlights:

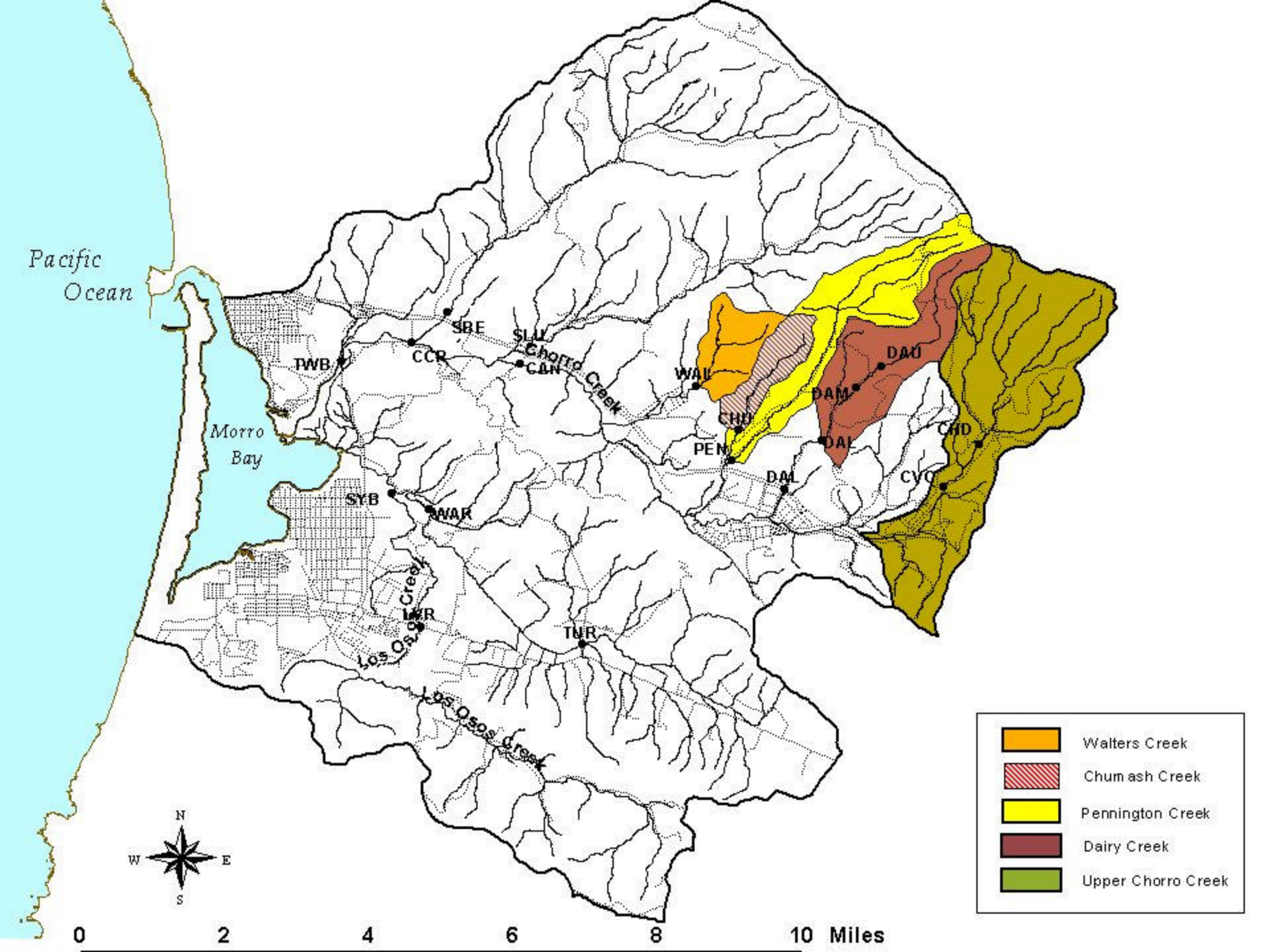
- Lake Champlain, Vermont
- Long Creek, North Carolina
- Lake Pittsfield, Illinois
- Jordan Cove, Connecticut

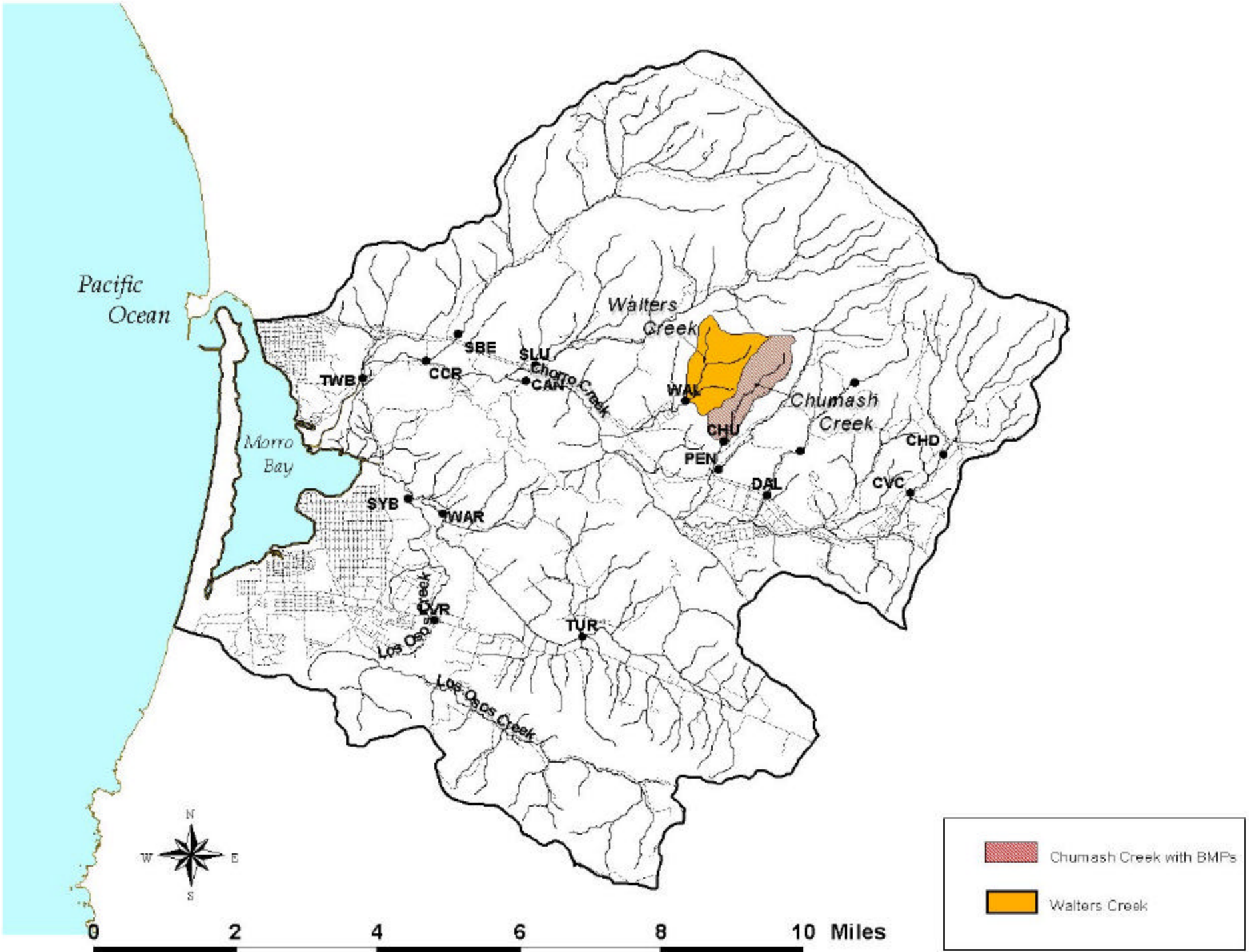
Morro Bay NMP Overall Objectives

- Detect changes due to BMPs
- Characterize sedimentation
- Evaluate water quality
- Evaluate indicators

Morro Bay
BMP Evaluation Projects

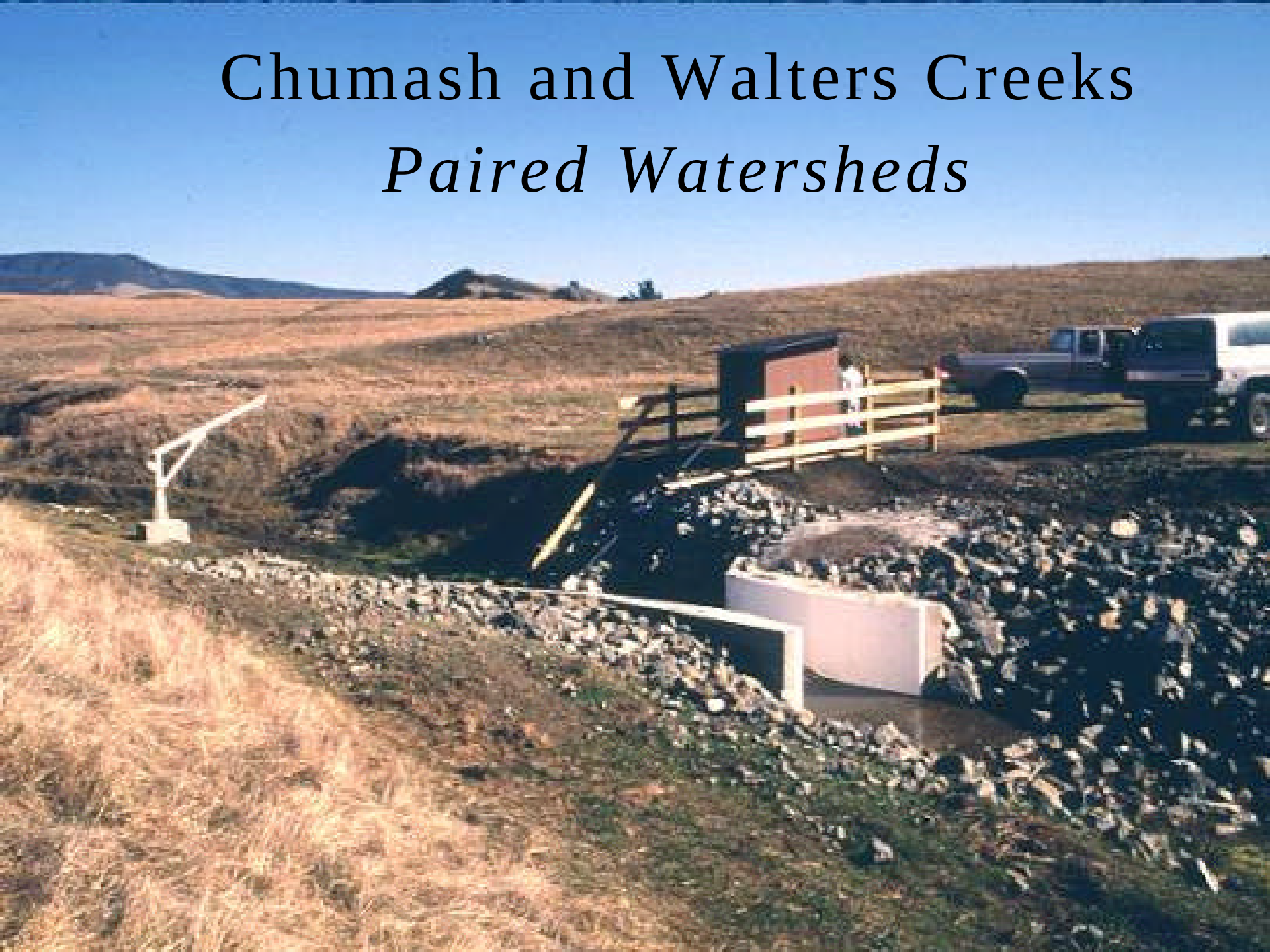
- Chumash and Walters Creeks
- Dairy and Pennington Creeks
- Upper Chorro Creek


Pacific Ocean
Morro Bay
SBE
SLU
Chorro Creek
CAN
CCR
PWB
WAL
CHU
PEN
DAM
DAU
DAL
CHD
CVC
SYB
WAR
Creek
LOR
Los Osos
TUR
Los Osos Creek
N
W
E
S
0
2
4
6
8
10 Miles
Walters Creek
Chumash Creek
Pennington Creek
Dairy Creek
Upper Chorro Creek

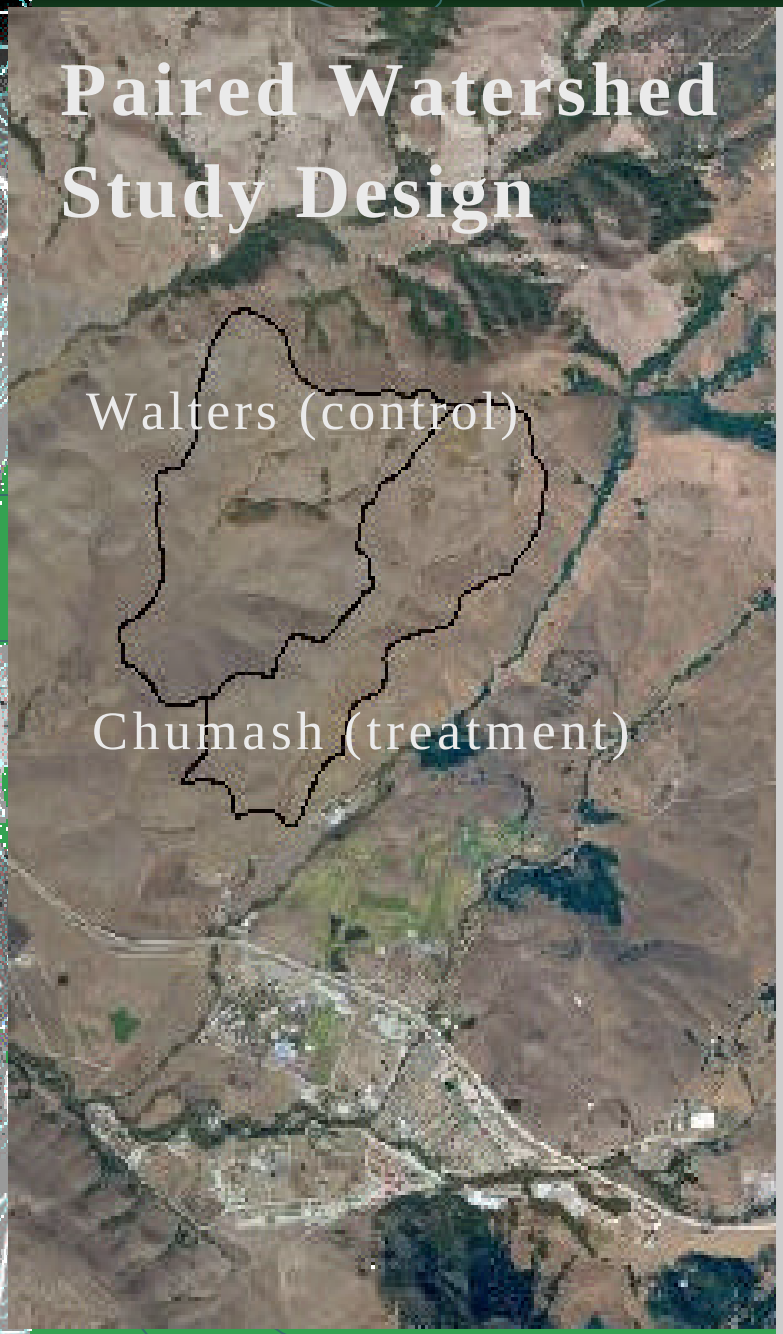

Pacific Ocean
Morro Bay
Walters Creek
Chumash Creek
Chorro Creek
Los Osos Creek
Los Osos Creek
TWB
CCR
SBE
SLU
CAN
WAL
CHU
PEN
DAL
CHD
CVC
SYB
WAR
DVR
TUR
N
W
E
S
0
2
4
6
8
10 Miles
Chumash Creek with BMPs
Walters Creek

Chumash and Walters Creeks

Paired Watersheds

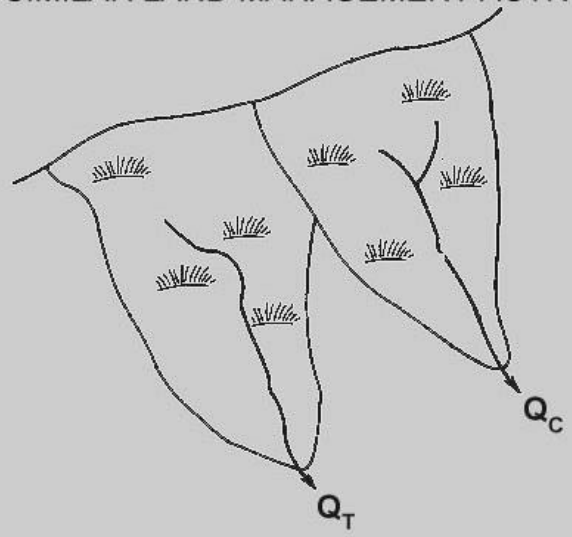


Paired Watershed Study Design



CALIBRATION PERIOD

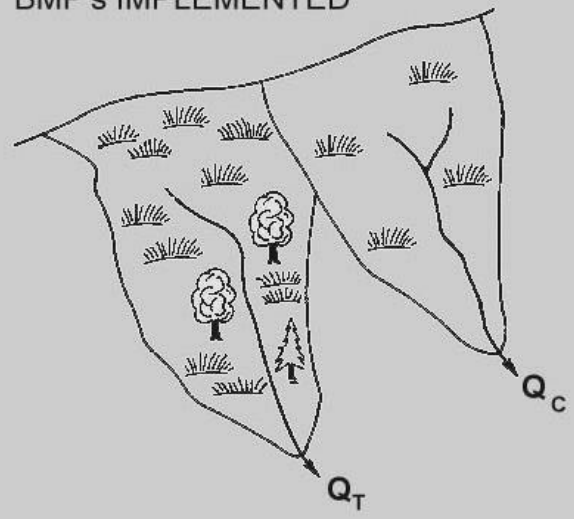
SIMILAR LAND MANAGEMENT ACTIVITIES



1993-1995

TREATMENT PERIOD

BMP's IMPLEMENTED



1997-2001

Chumash Creek BMPs

Riparian pastures

Rest-rotation grazing

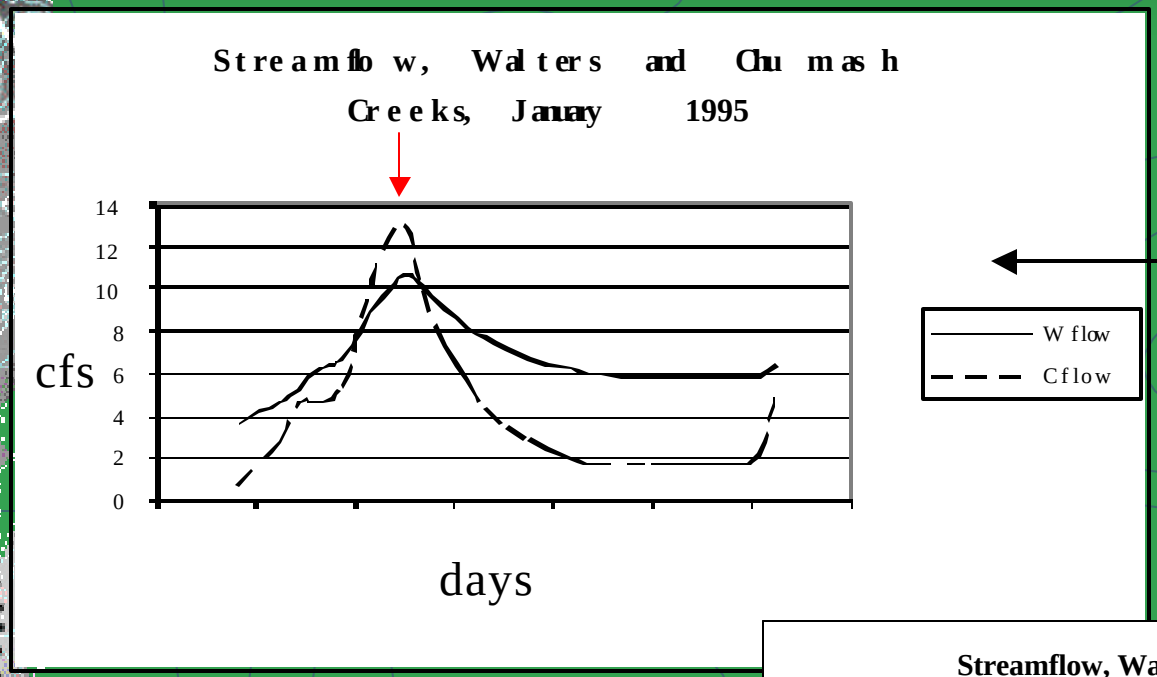
Alternative water supplies

Road improvements

Revegetation

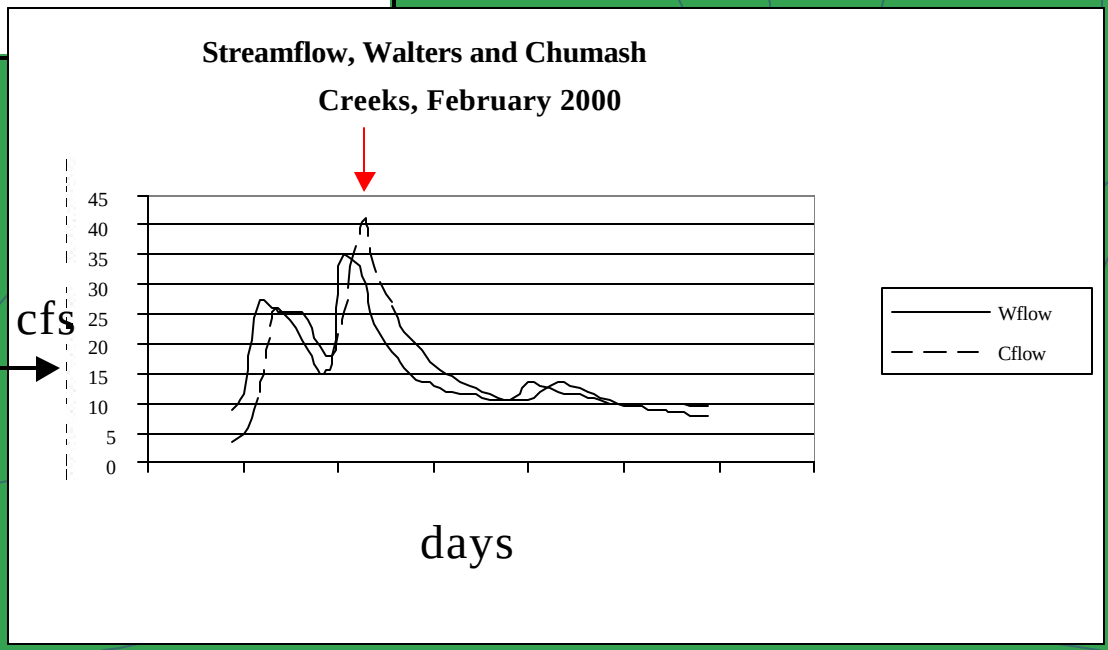
1995-1997

Peak Flow Delayed

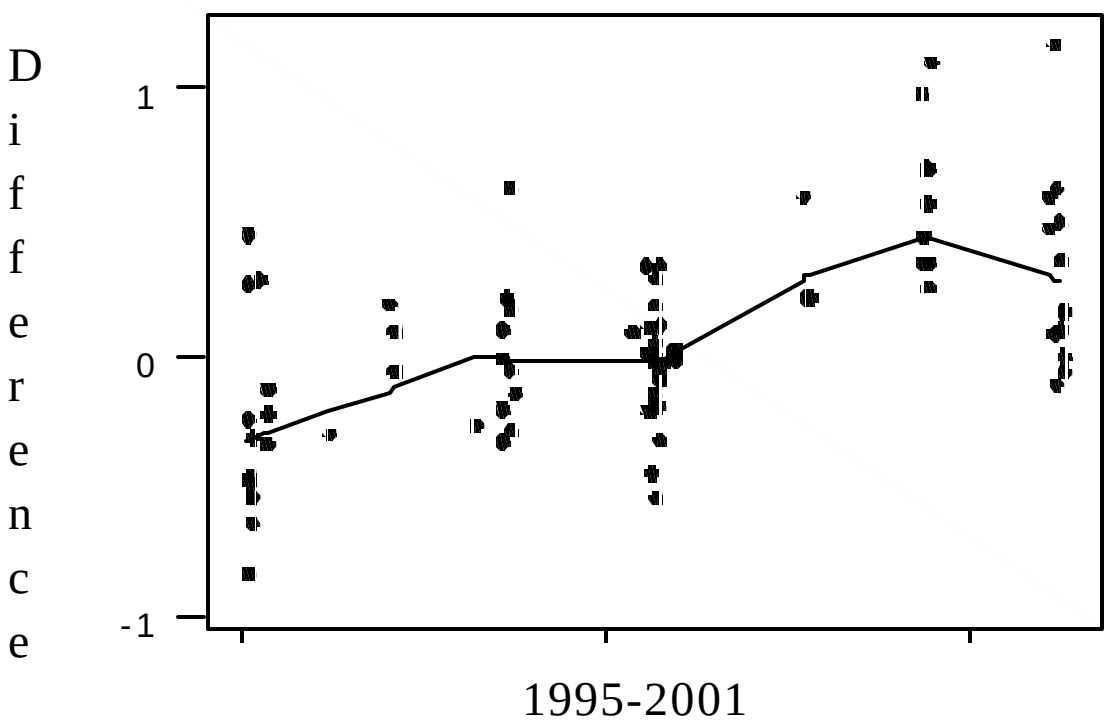


Pre-BMP period

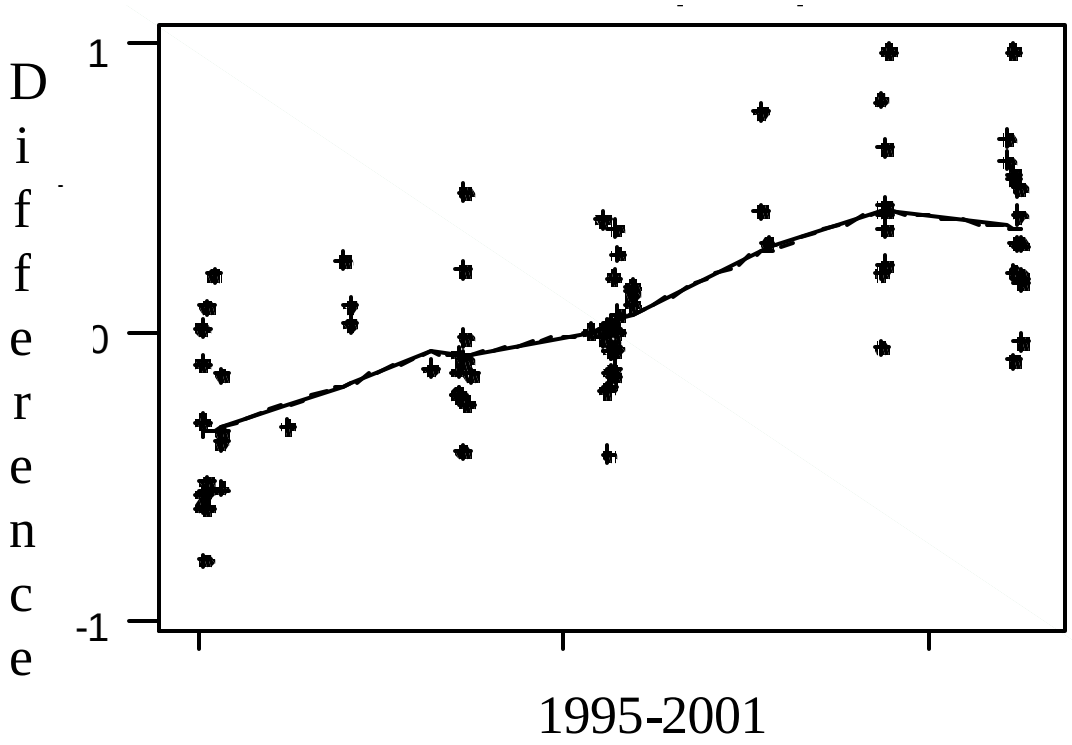
Post-BMP period



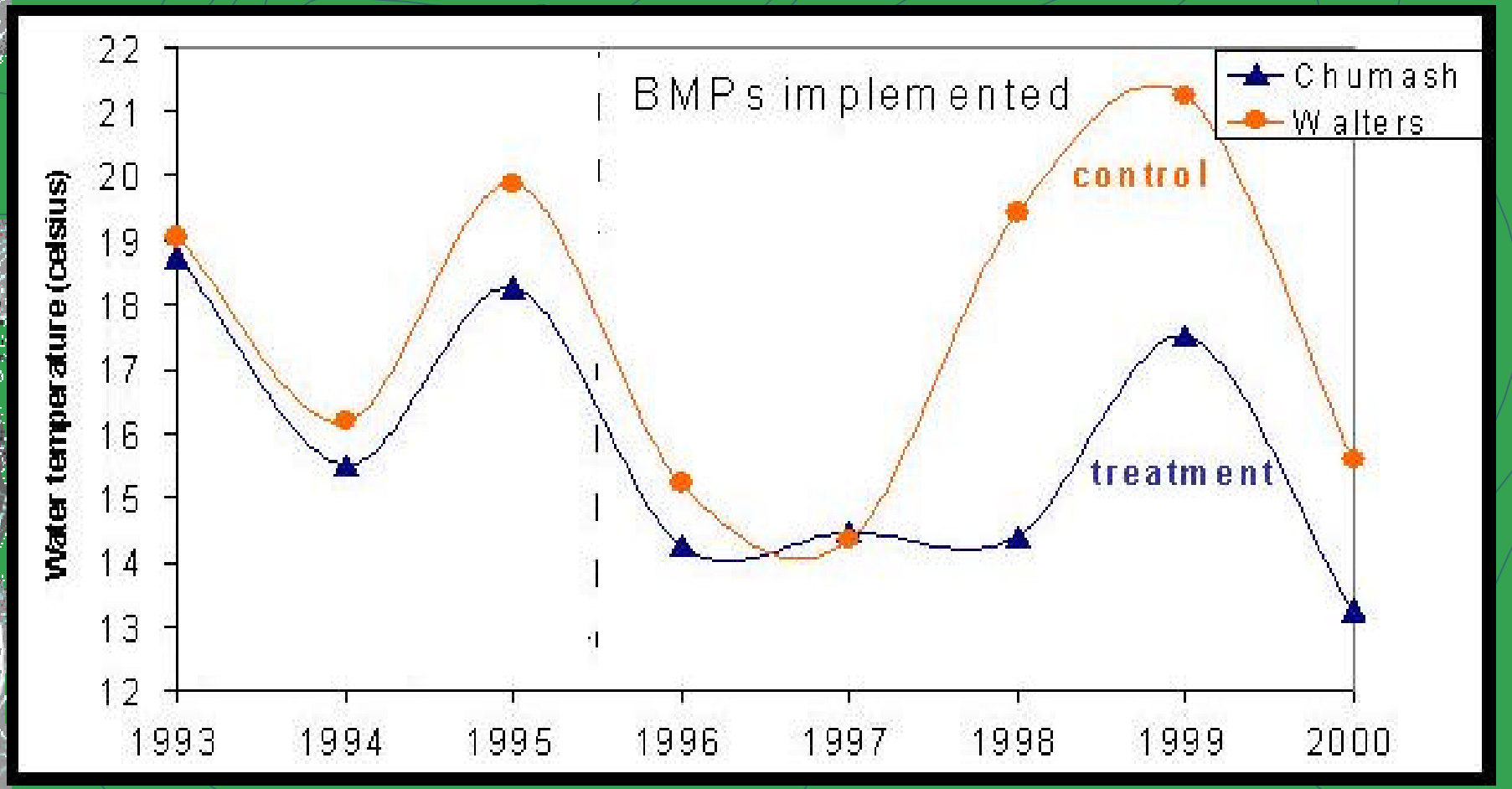
Improved Suspended Sediment



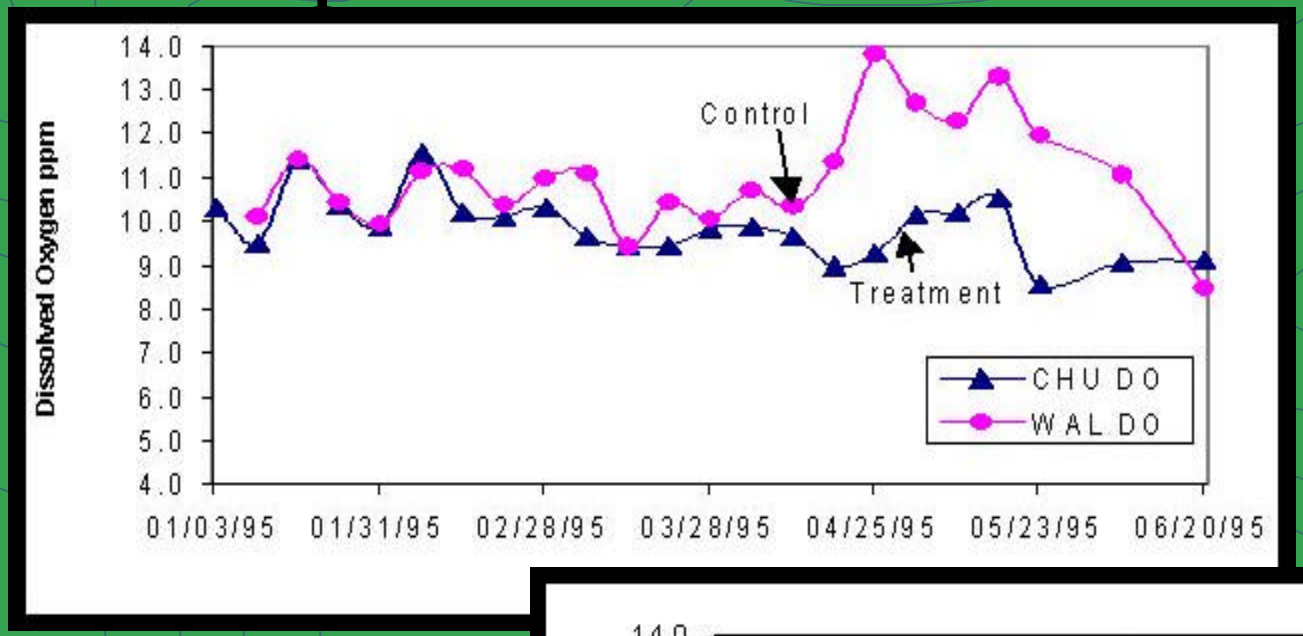
Improved Turbidity



Improved Water Temperature

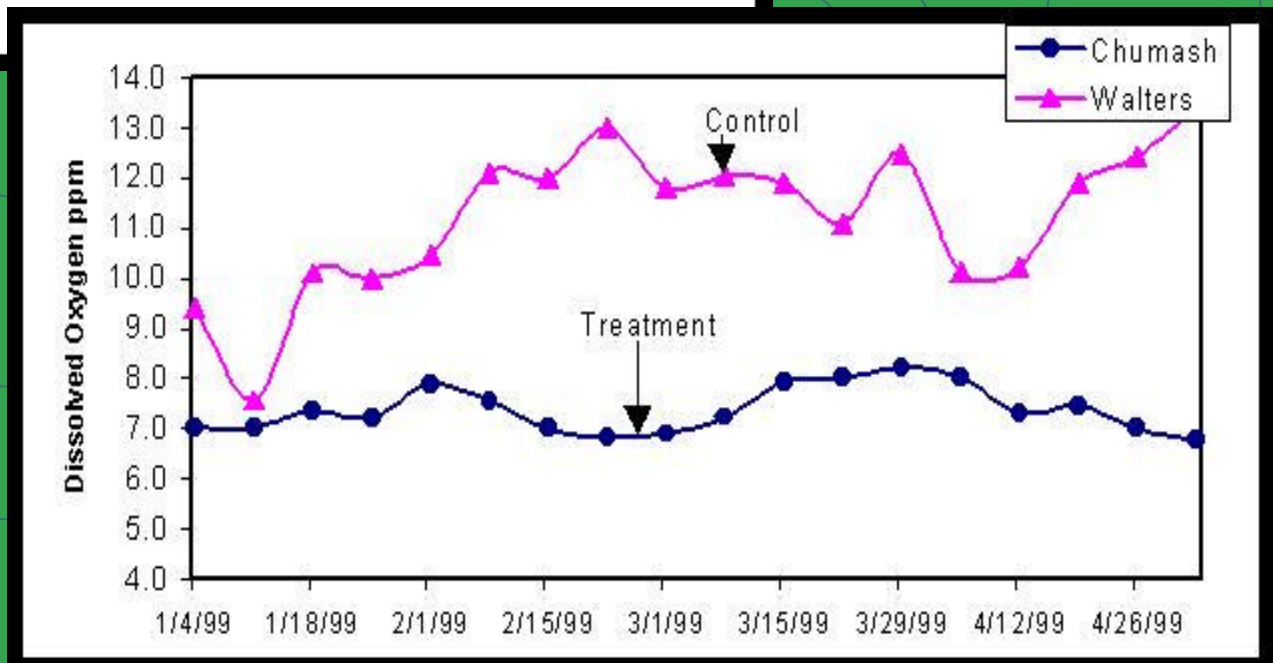


Improved Dissolved Oxygen



Pre-BMP period

Post-BMP period



Summary of Significant Findings

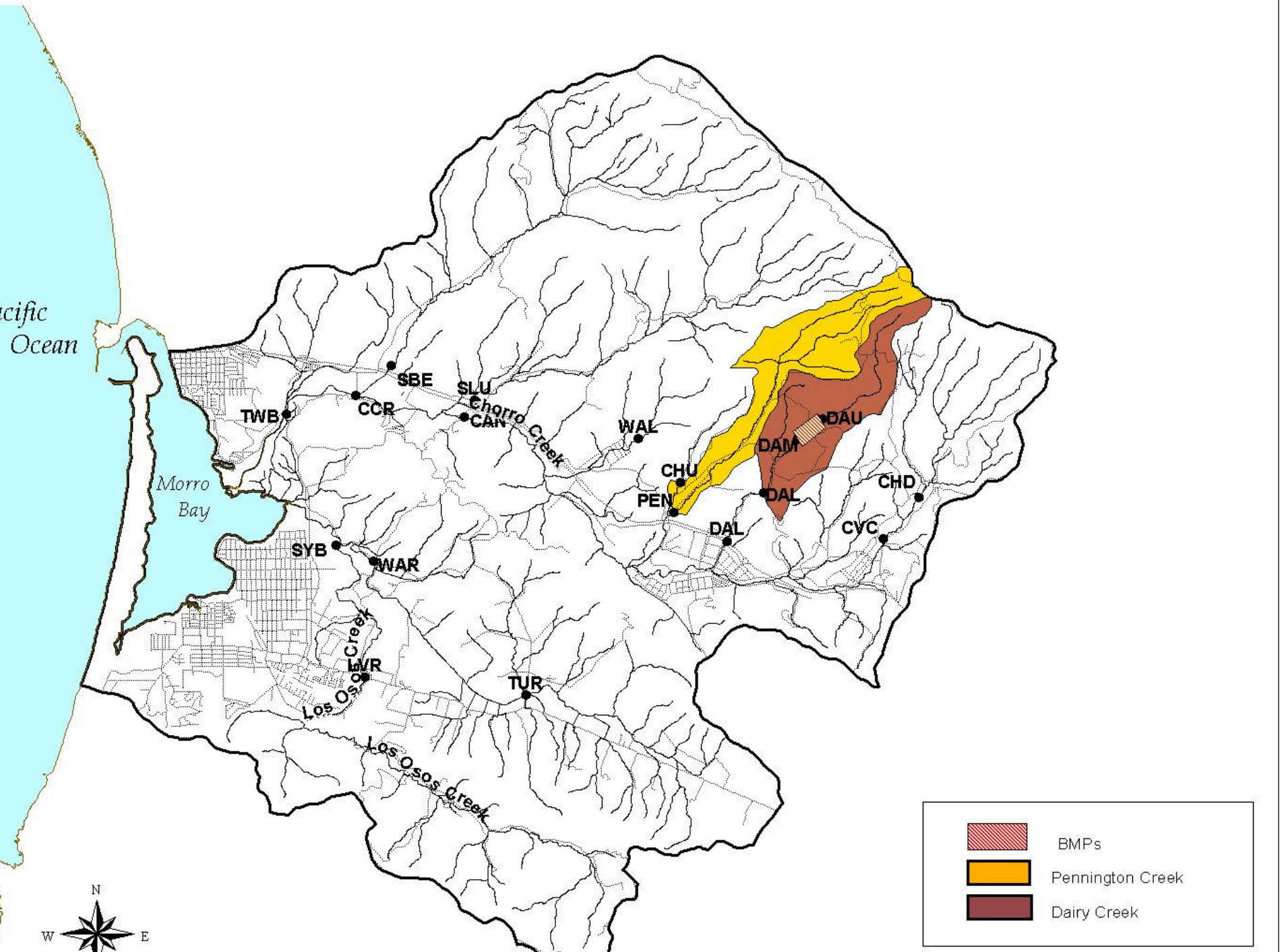
- Storm-event changes:
  - Suspended sediment
  - Turbidity
  - Peak flow
- Year-round changes:
  - Water temperature
  - Dissolved oxygen
  - Lower threshold turbidity
  - Nitrate
- No changes:
  - Ortho-phosphate
  - Fecal coliform
  - Higher threshold turbidity

Trend Observations

- In-stream vegetation increased
- Rangeland vegetative cover increased
- Bare-ground decreased
- Supplemental feeding costs decreased
- Improved cattle behavior and health

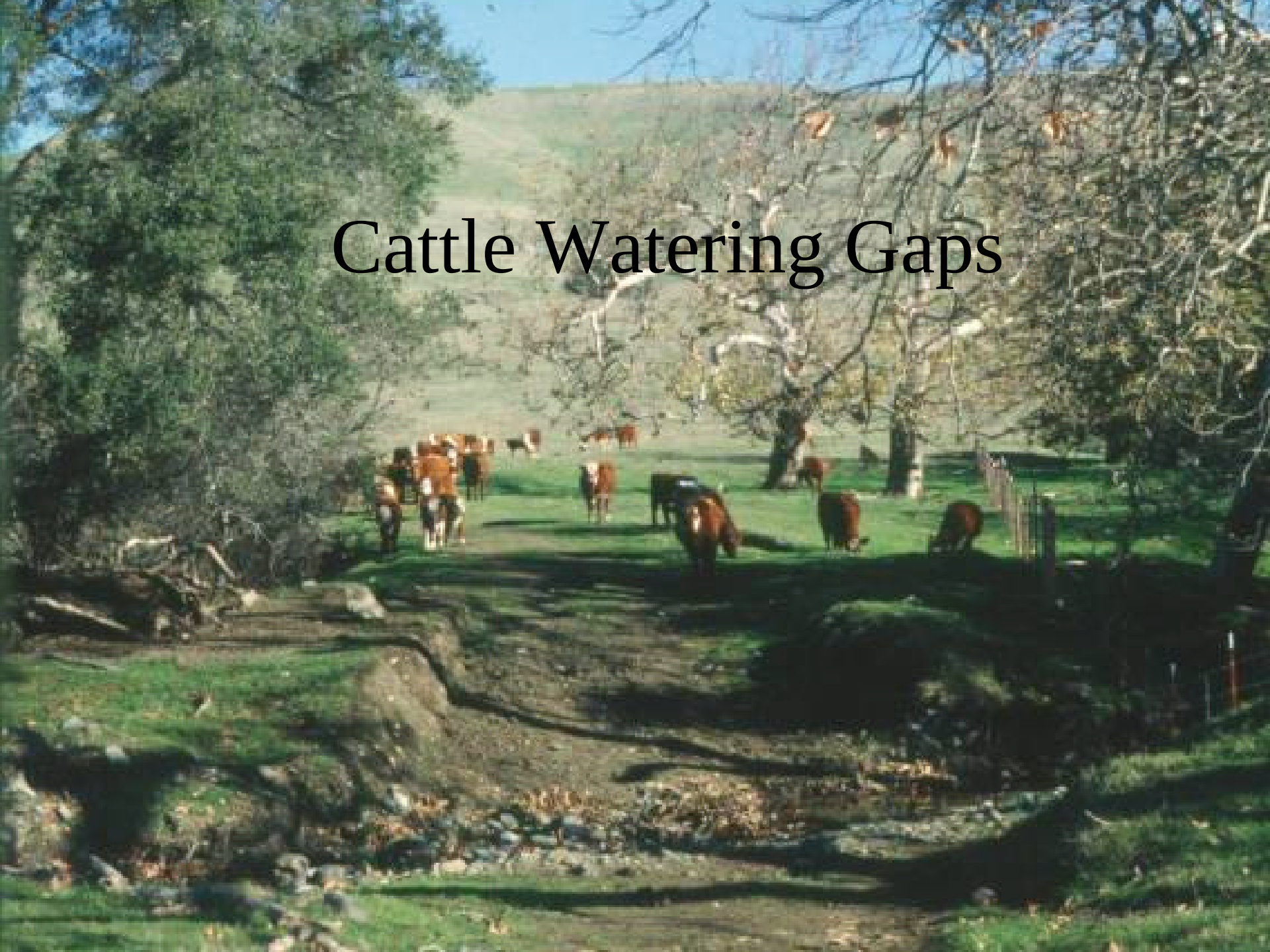
Dairy Creek and Pennington Creek

BMP Evaluation Project


cific
Ocean
Morro
Bay
SBE
SLU
TWB
CCR
CAN
Chorro Creek
WAL
DAU
DAM
CHU
PEN
DAL
CHD
DAL
CVC
SYB
WAR
Los Osos Creek
LOVR
TUR
Los Osos Creek
N
W
E
BMPs
Pennington Creek
Dairy Creek

Dairy and Pennington Creeks

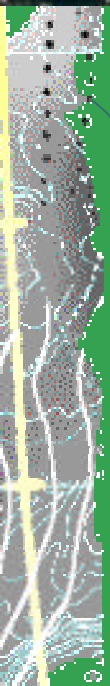
- Revegetation
- Reduced cattle and rangeland area
- Cattle exclusionary fencing


Cattle Watering Gaps

Summary of Significant Findings

- Year-round changes:
  - Water temperature
  - Dissolved oxygen
- No changes:
  - Fecal coliform bacteria
  - Nutrients
  - Turbidity

Pre-BMP period



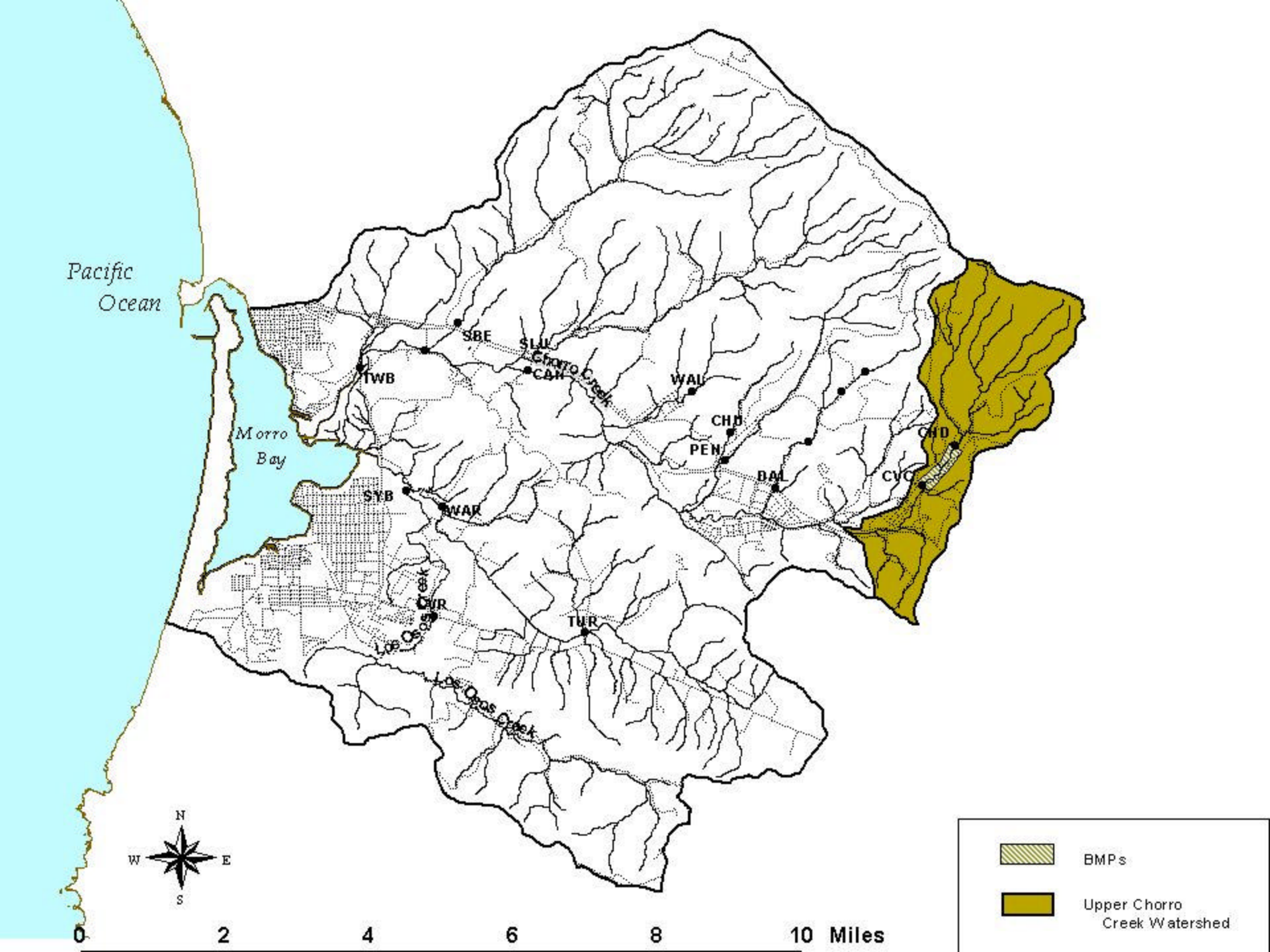
Post-BMP period

Trend Observations

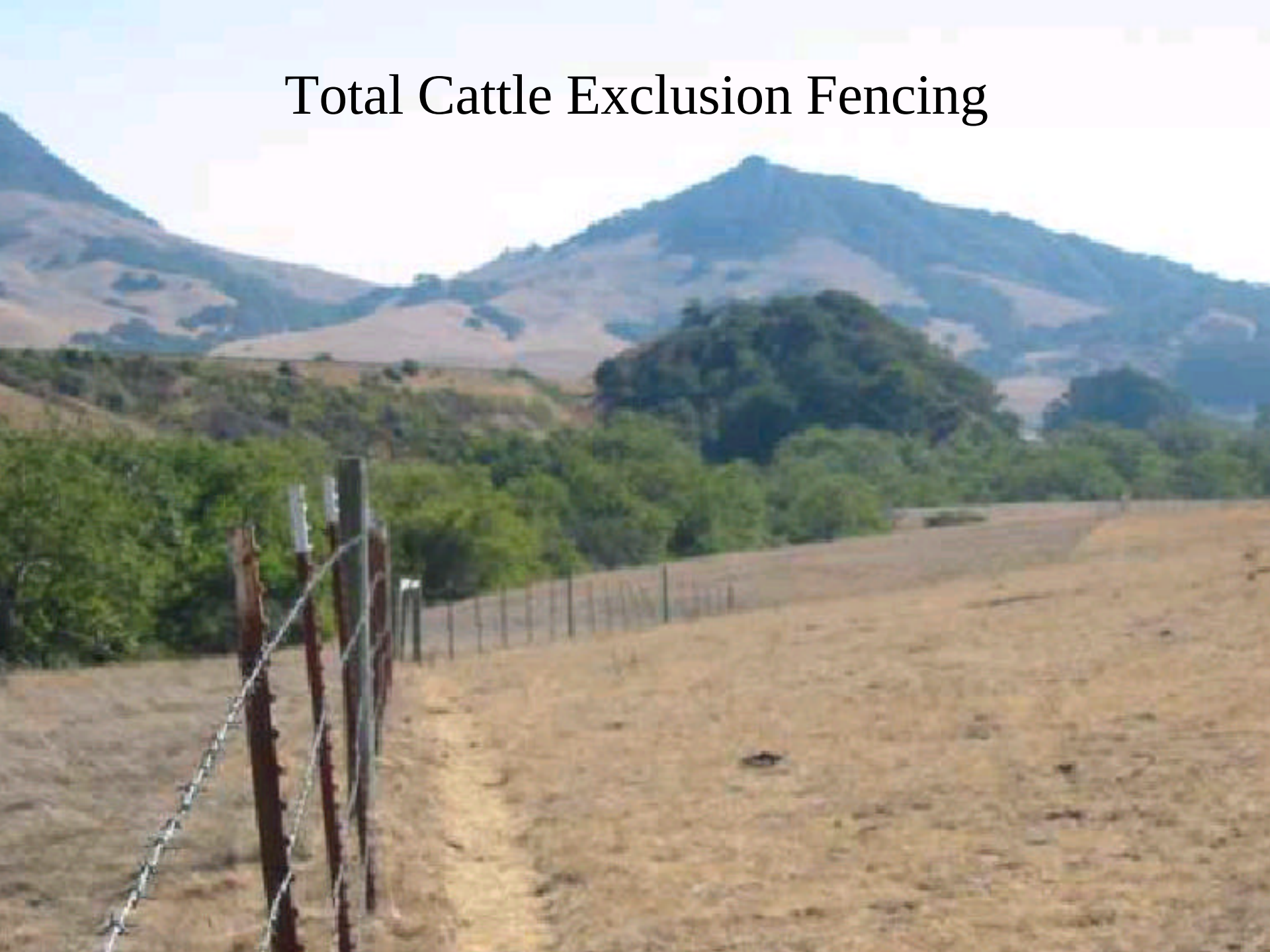
- Riparian corridor health
- Index of Biological Integrity
- Stream morphology

Upper Chorro Creek

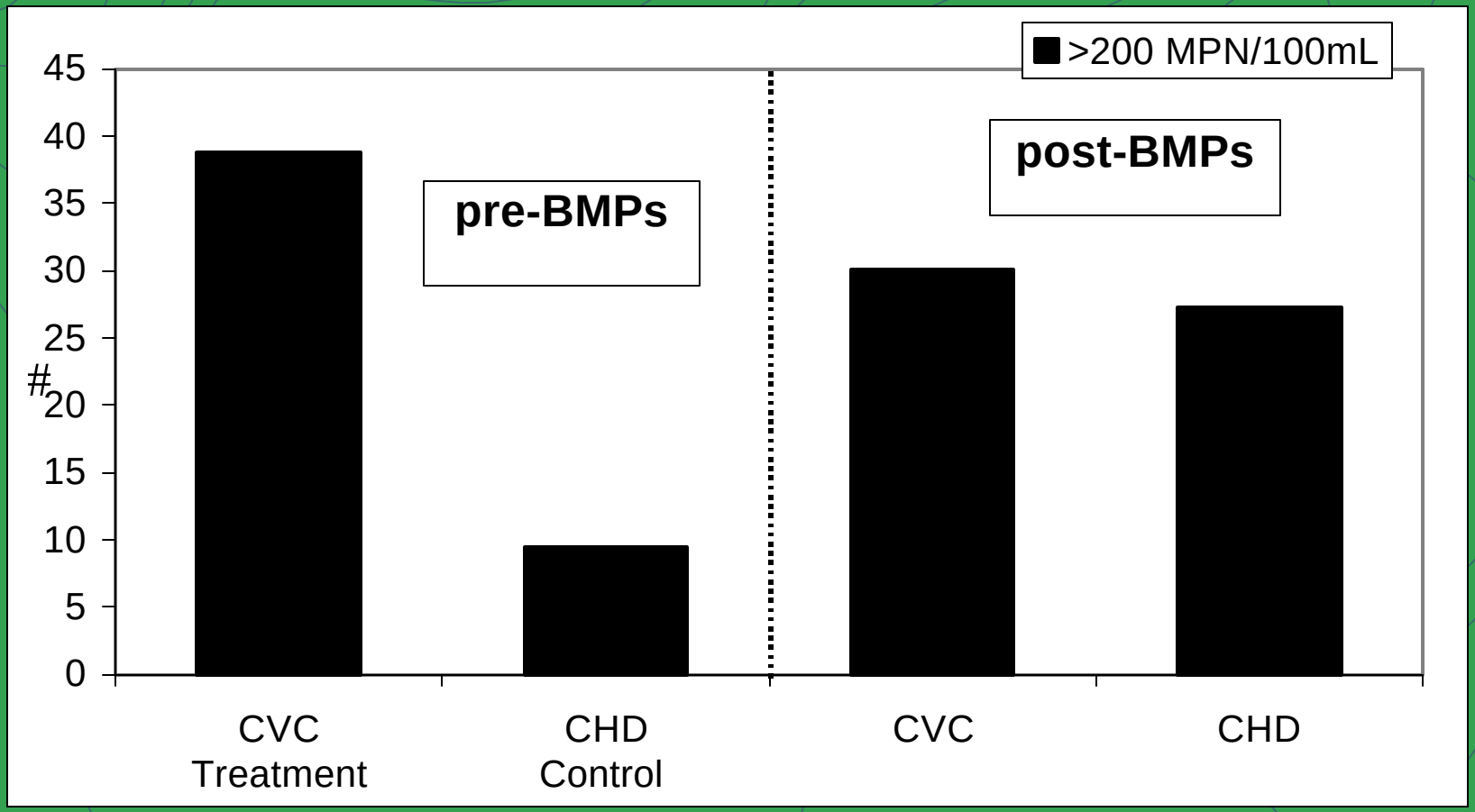
BMP Evaluation Project


Pacific Ocean
Morro Bay
SBE
SLU
Chorro Creek
CAH
TWB
WAL
CHD
PEN
DAL
CVC
SYB
WAR
CVR
TUR
Los Osos Creek
N
W
E
S
0
2
4
6
8
10 Miles
BMPs
Upper Chorro Creek Watershed

Total Cattle Exclusion Fencing



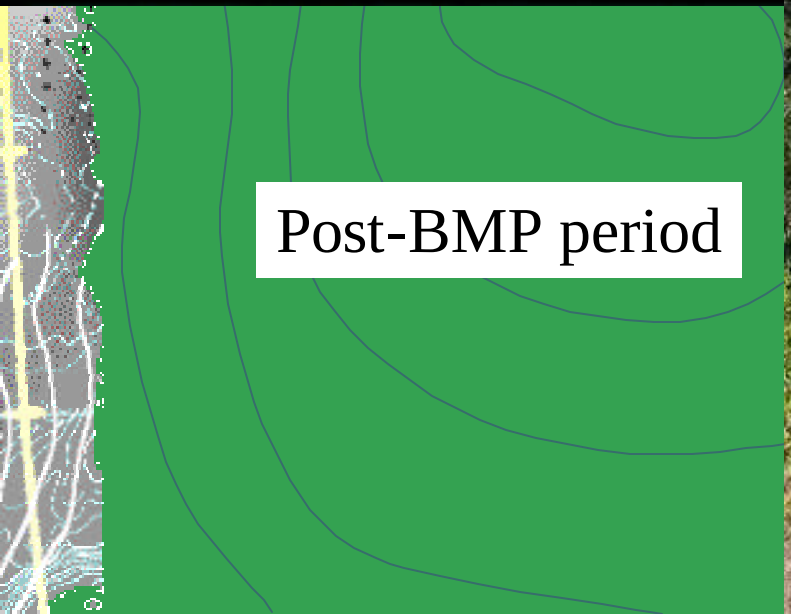
Fecal Coliform Bacteria



Summary of Significant Findings

- Year-round changes:
  - Water temperature
  - Dissolved oxygen
  - Fecal coliform bacteria
- No changes:
  - Nutrients
  - Turbidity

Pre-BMP period



Post-BMP period

Trend Observations

- Index of Biological Integrity
- Stream Morphology
- Riparian Corridor Health

Morro Bay NMP Conclusions

- Rangeland BMPs improve
  - Flow
  - Suspended sediment and turbidity
  - Water temperature and dissolved oxygen
- Total cattle exclusion reduces fecal coliform
- BMPs improve riparian habitat and rangeland vegetation

Other NMP Project Highlights:

- Lake Champlain, Vermont
- Long Creek, North Carolina
- Lake Pittsfield, Illinois
- Jordan Cove, Connecticut

Lake Champlain, Vermont

Improved

Total Phosphorous

and

Bacteria

Long Creek, North Carolina

Improved Turbidity,

Sediment,

Fecal Coliform, and

Total Phosphorous

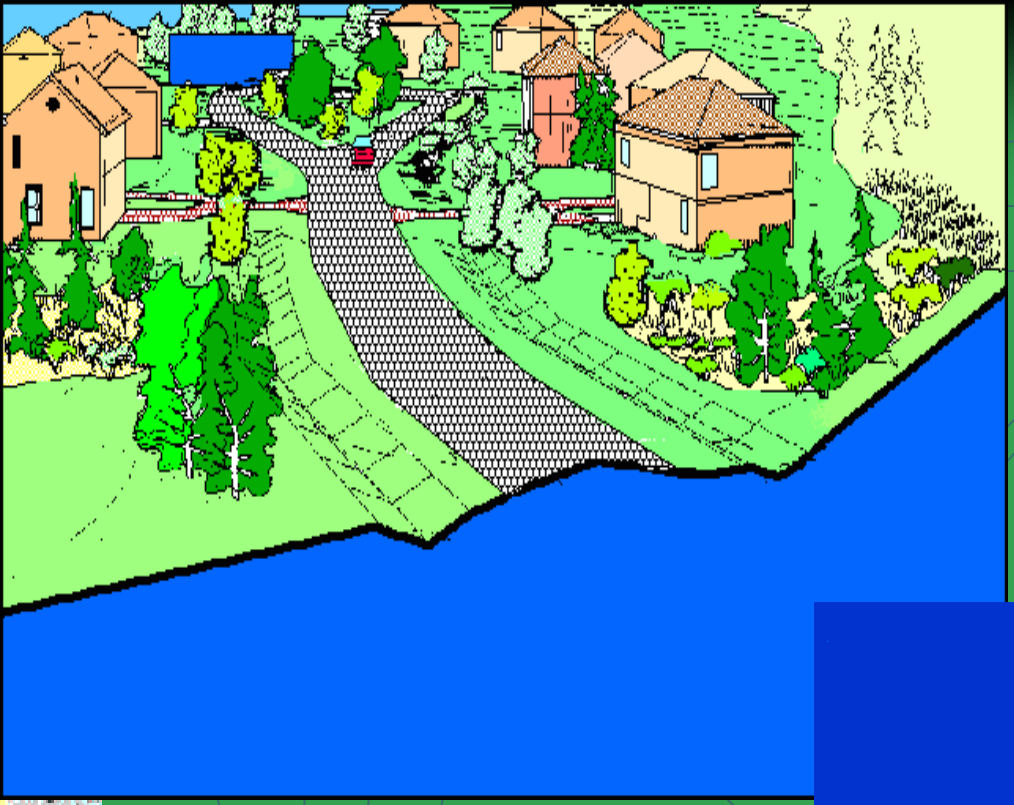
Lake Pittsfield, Illinois

Improved

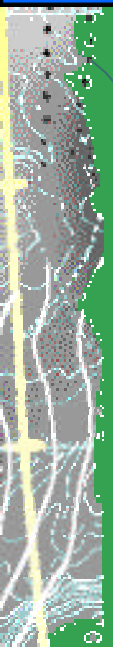
Sediment loading

Jordan Cove, Connecticut

Control
Neighborhood



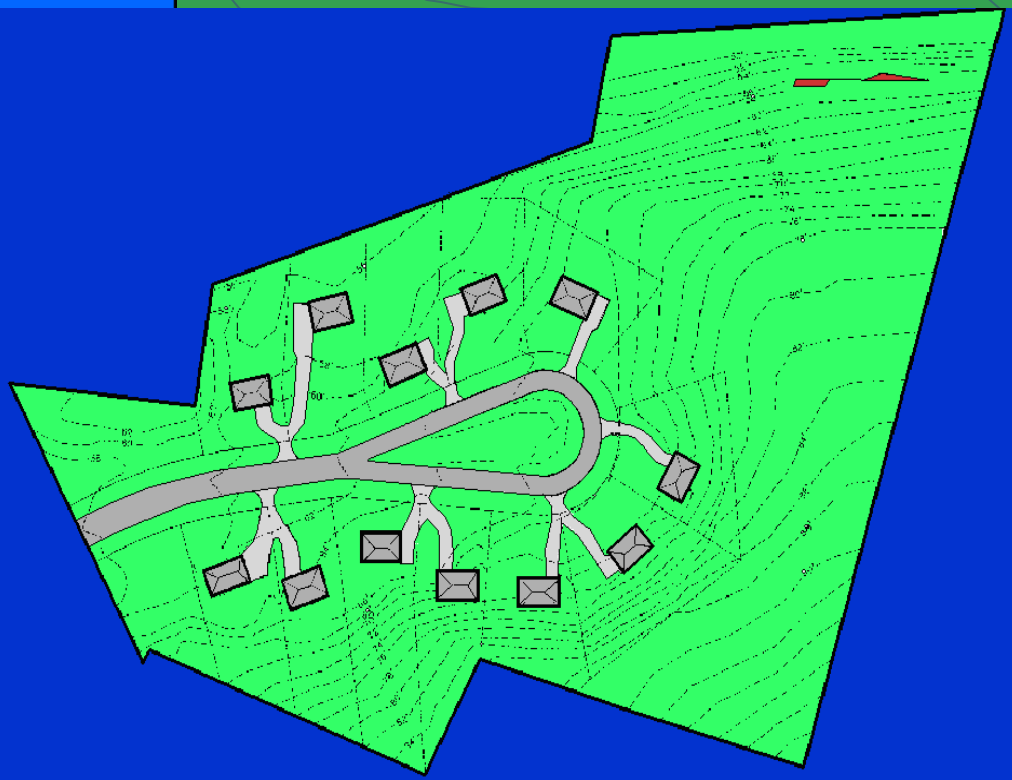
BMP
Neighborhood



Improved Flow

Sediment and

Nutrients



Section 319 National Monitoring Program Projects

Do BMPs Really Work?

YES!

Additional Information

www.swrcb.ca.gov/rwqcb3/WMI/MorroBay/index.htm

Other Morro Bay NMP Data Usages

- Watershed Characterization
- Numerical Models
- Total Maximum Daily Loads
- Regional Monitoring Program
- Student Projects
- Prioritizing BMP implementation
- Characterize rangeland productivity
- Volunteer Monitoring Program

Morro Bay NMP Lessons Learned

- Scope
- Flow Data
- Statistics
- Consistency
- Coordination

Storm-event Water Quality Parameters

- Flow
- Turbidity
- Suspended sediment
- Rainfall

Year-Round Water Quality Parameters

- Water temperature
- Dissolved oxygen
- Turbidity
- Total and fecal coliform
- Nitrate
- Ortho-phosphate
- Conductivity
- pH

Habitat Quality Parameters

- Rapid bioassessment
- Stream morphology
- Photo documentation
- Vegetative diversity
- Vegetative cover
- Forage Quality